How many elk should there be? A history of the concept of carrying capacity in Rocky Mountain National Park

Science Behind the Scenery Lecture

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1977

National Parks and global conservation

Human caused extinctions of animals

- Over exploitation
- Loss of habitat
- Invasive species
- Pollution

Protection and reintroduction as conservation tool

- American bison
- Rocky Mountain elk
- Grey wolf
- Black bear
- Peregrine falcon
- American alligator
- songbirds
- amphibians

Protection can cause overabundance

Mission of National Park Service

"The National Park Service preserves unimpaired the natural and cultural resources and values of the National Park System for the enjoyment, education, and inspiration of this and future generations."

Goal of talk

How many elk should there be? What is the "carrying capacity" of Rocky Mountain National Park?

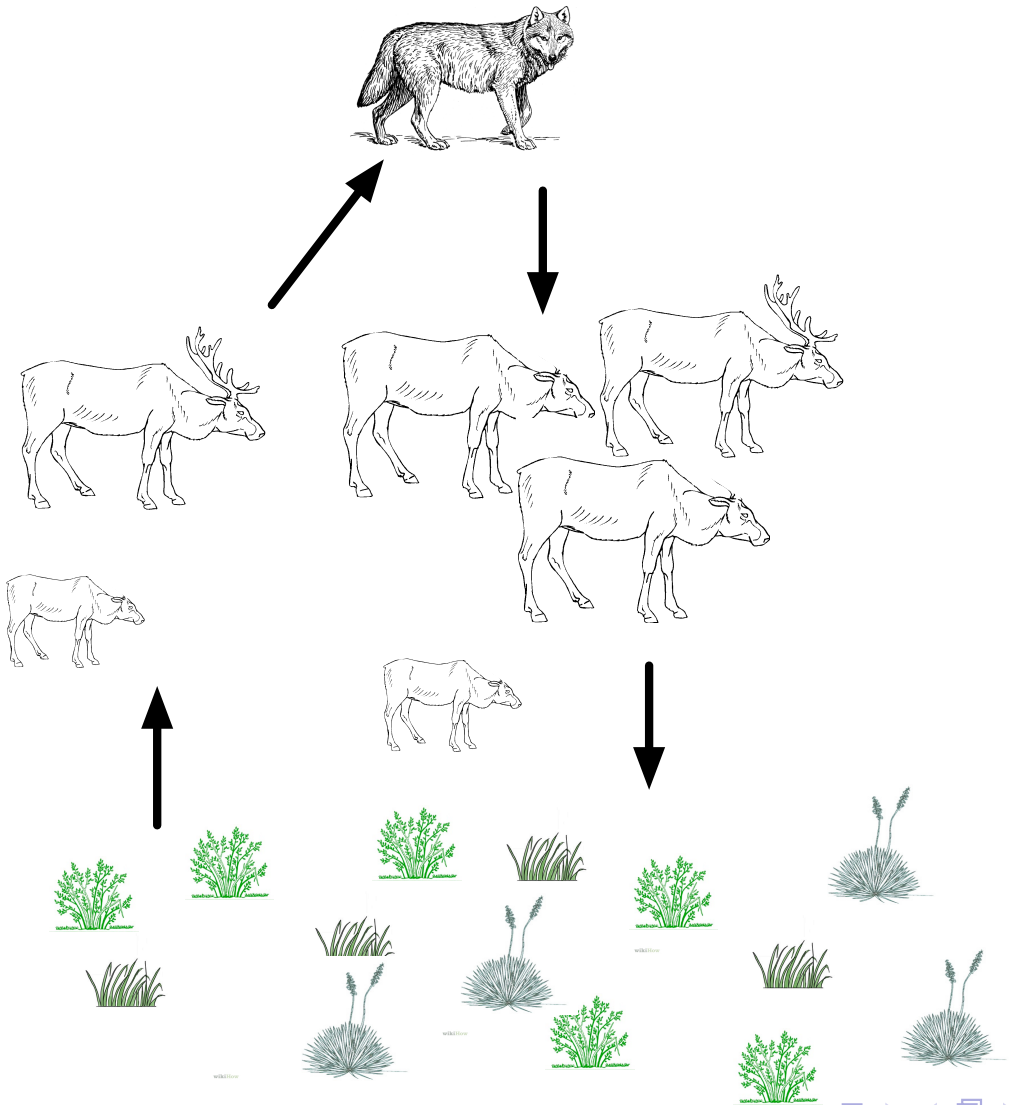
Roadmap

- Some basic population ecology
- Some history
- Elk in Rocky Mountain National Park today
- Concluding thoughts

Crosscutting idea

Decisions are based on values combined with the *current* state of science.

How are populations regulated?



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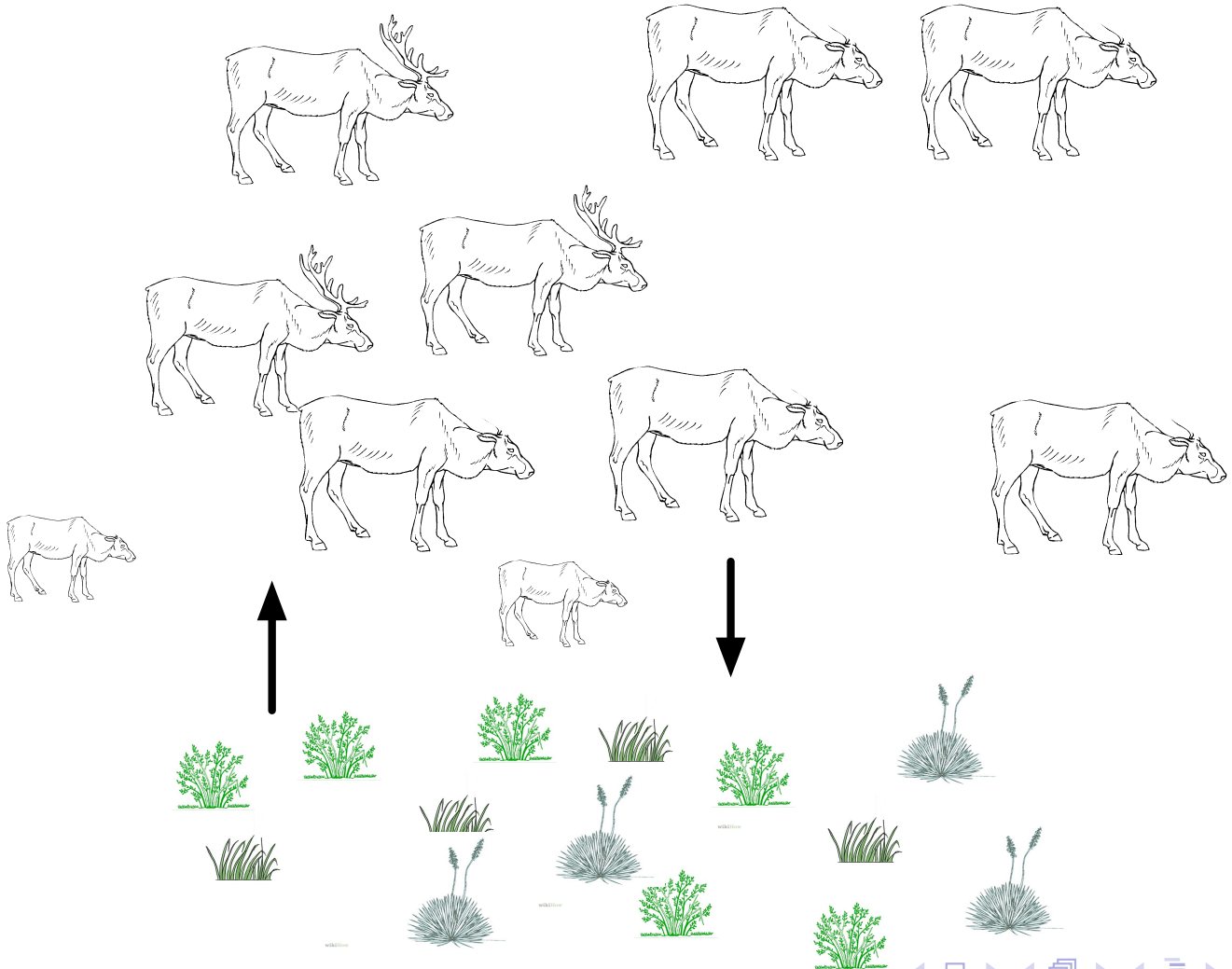

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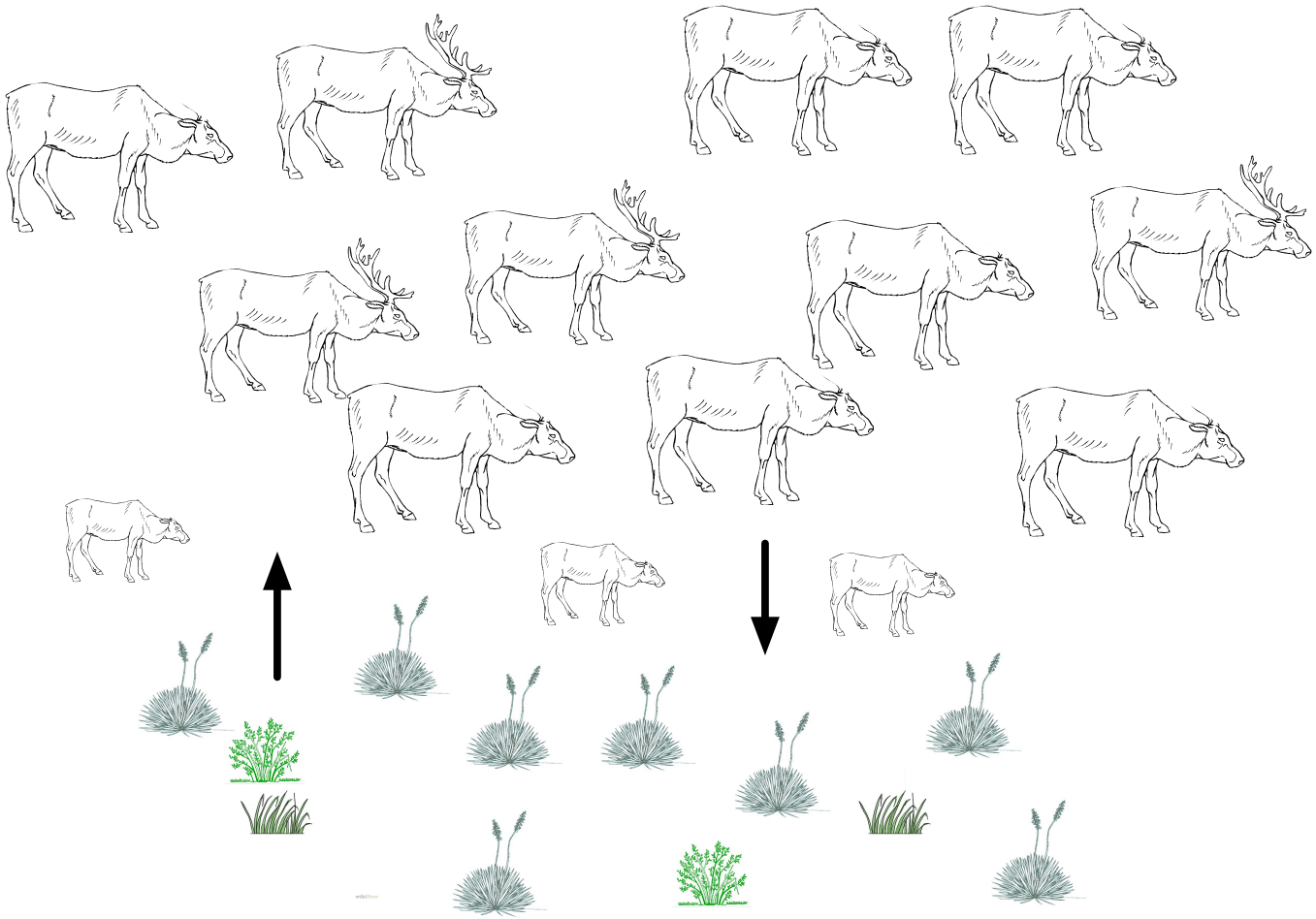

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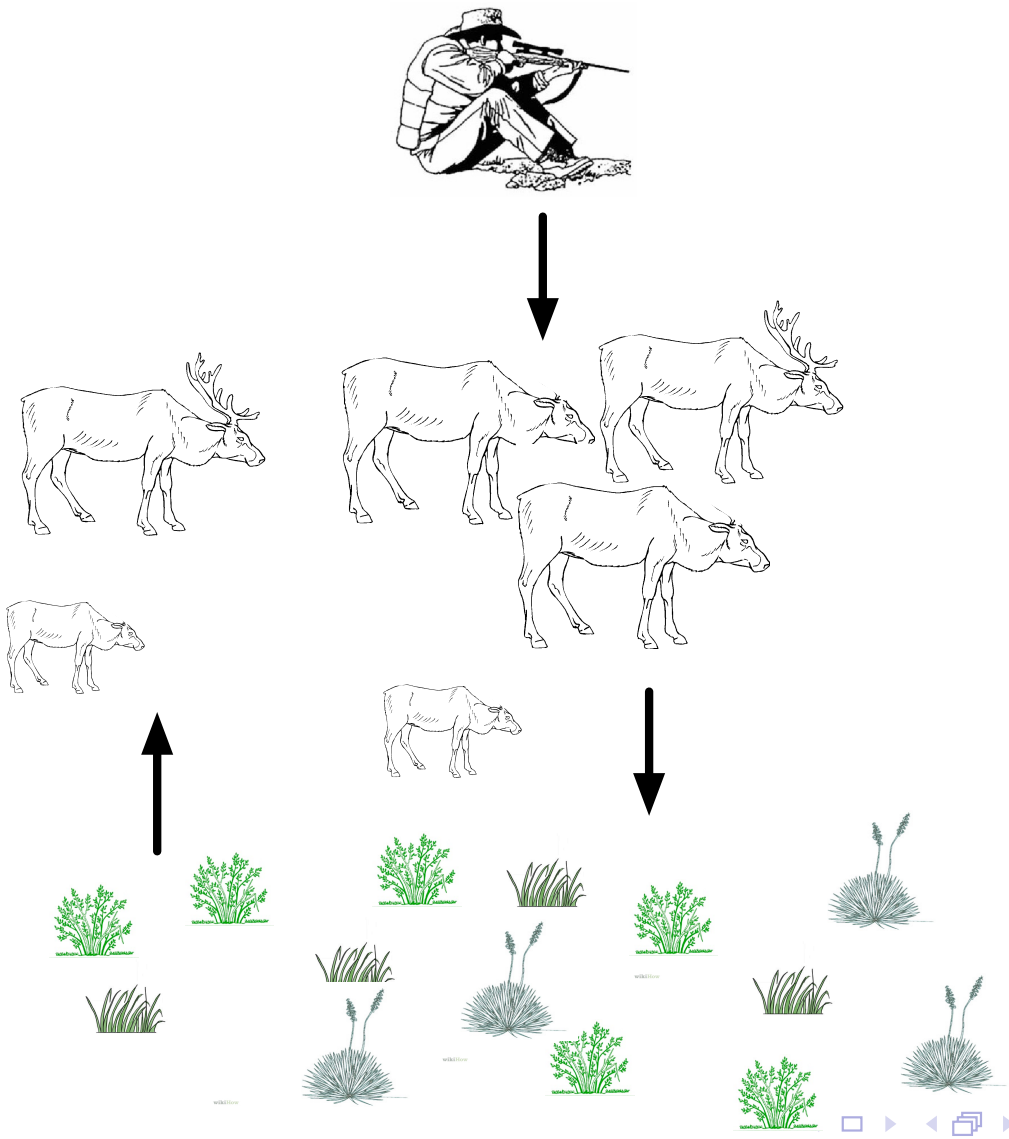
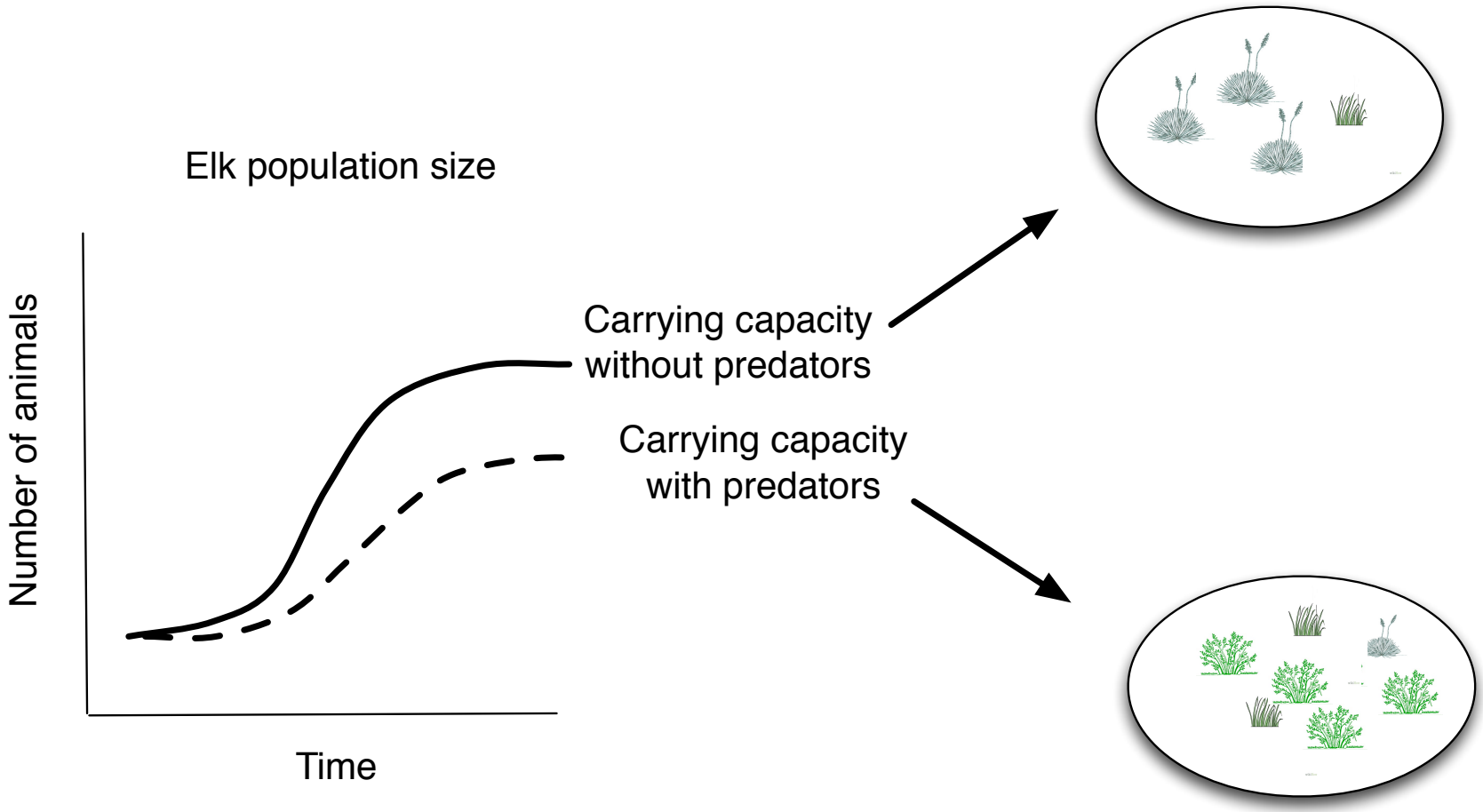


Ecological theory



Definitions of carrying capacity

1. **Ecological:** the number of animals at steady state determined by food supply
2. **Economic:** the number of animals that provide maximum animal productivity
3. **Ecosystem:** the number of animals that allow for historic range of variation in ecosystem states and processes

1800's - 1900 Loss of wildlife[1]

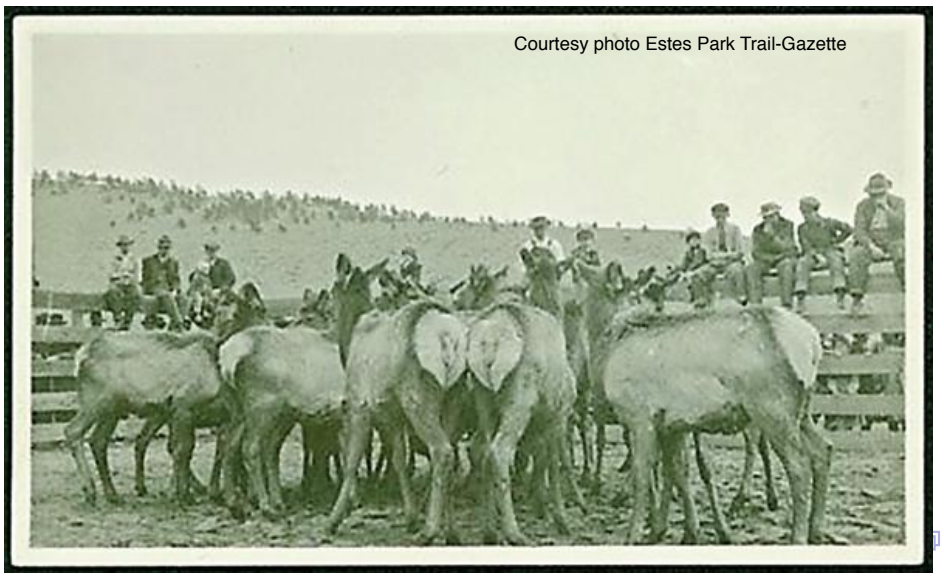
- Hay meadows established on elk winter range
- Grizzly bears and wolves exterminated
- Elk extirpated as a result of market hunting

The National Park Service supported aggressive predator control.

[1] Information collated by Cyrenea Piper, National Park Service

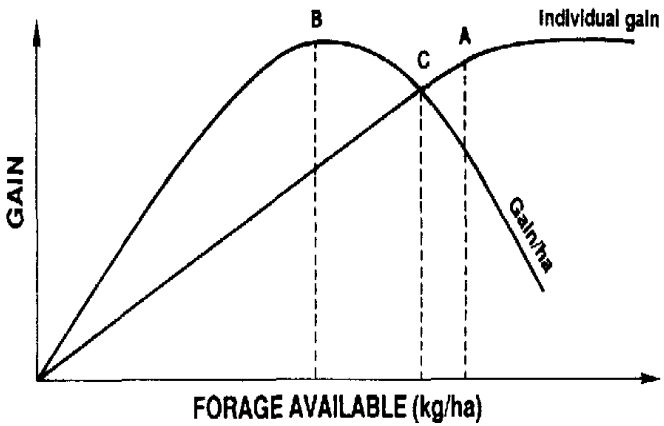
1900-1930 Reintroduction and growth

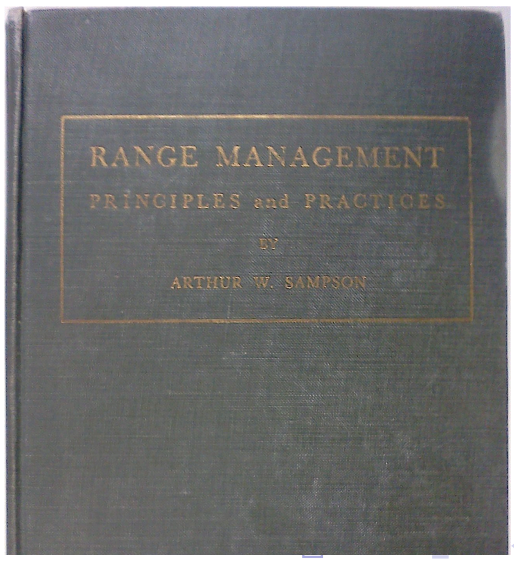
- Elk reintroduced to Estes Valley from Yellowstone National Park
- 1915 Rocky Mountain National Park established with elk population = 30 animals
- Population grows to 350 animals by 1930
- Concerns about elk population size and vegetation condition
- Winter range purchased in Moraine Park, Beaver Meadows, and Horseshoe Park.



1930 - 1968 Range Management

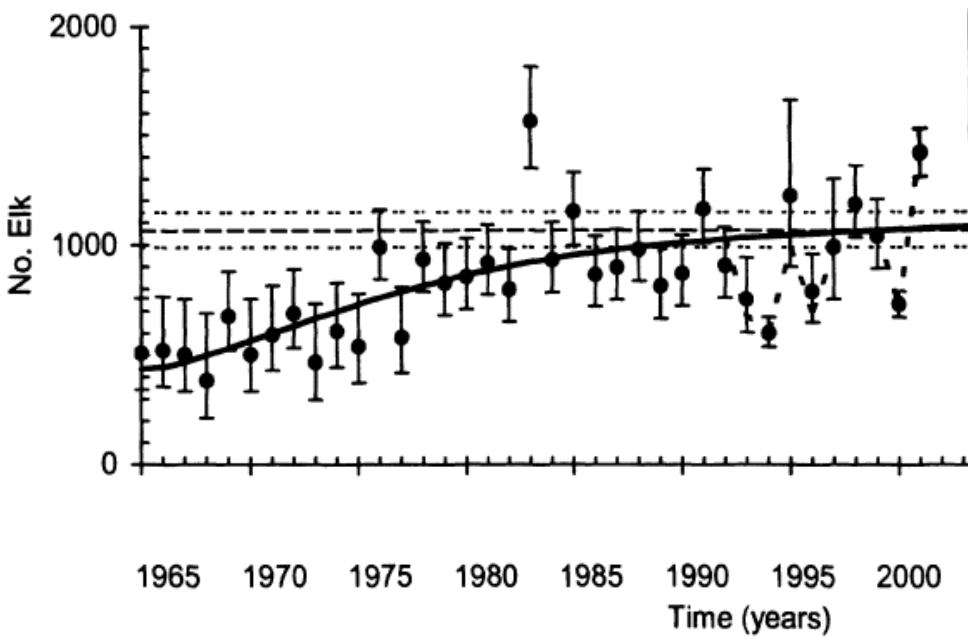
- Emergence of science of range management
- Measurements of range condition indicate damage.
- Culling within the Park used to keep population in check ($<$ 700 animals)
- 1962 Culling eliminated and replaced with boundary hunting and trapping a transplanting to reduce animal numbers.





1965-1990's Natural Regulation

- Ecological theory influenced park managers.
- All culling within parks stopped.
- Elk populations grew rapidly to a "steady state".
- Grazing and browsing by large populations of elk changed plant communities.

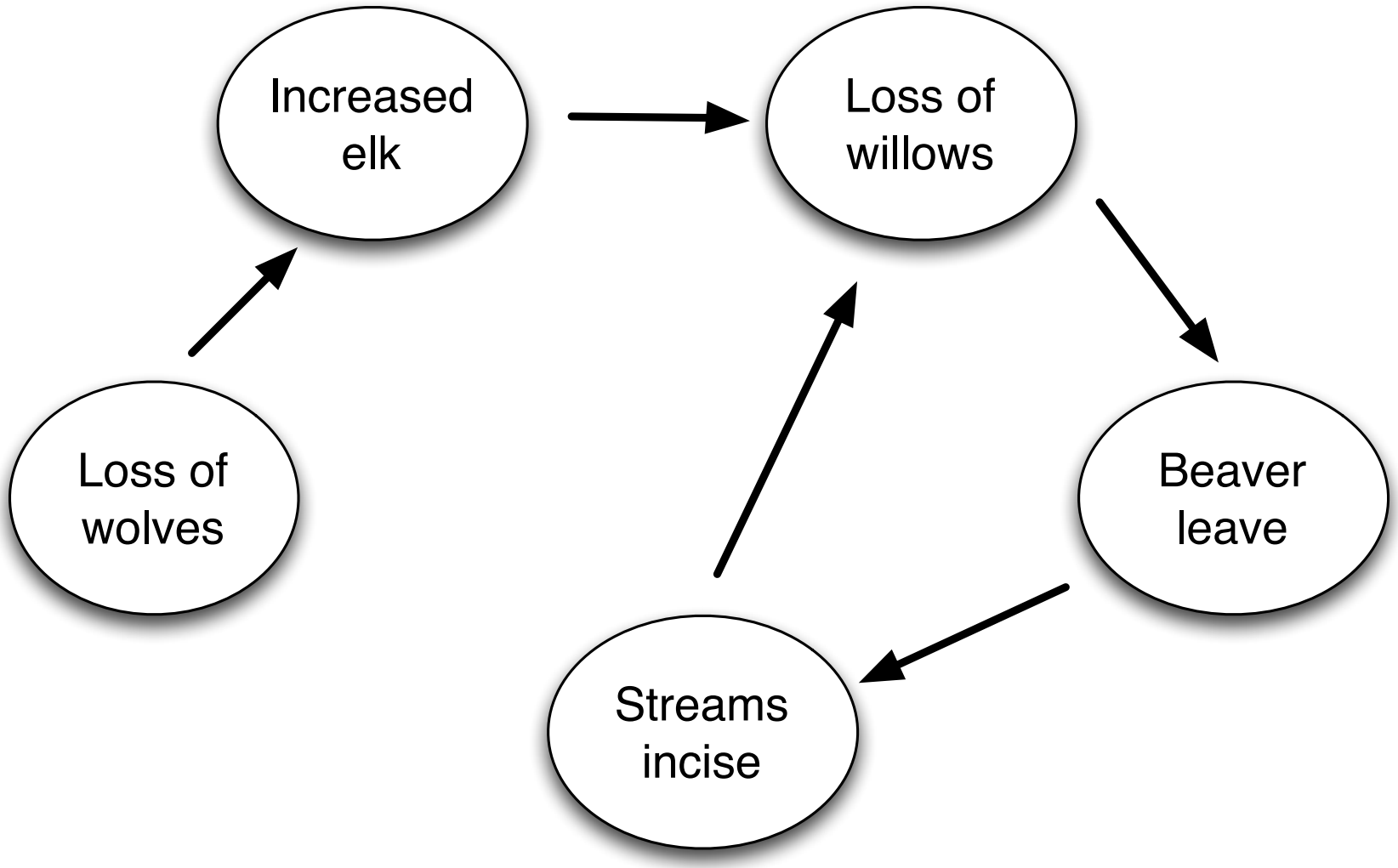


Effects of elk on vegetation

Effect of elk on vegetation

Effect of elk on ecosystem processes

Ecosystem effects



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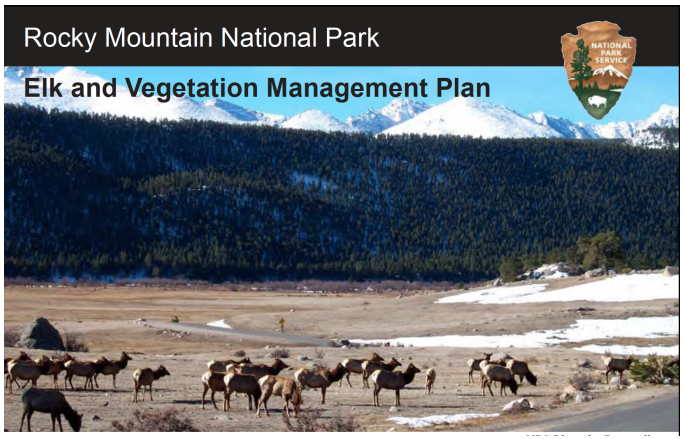
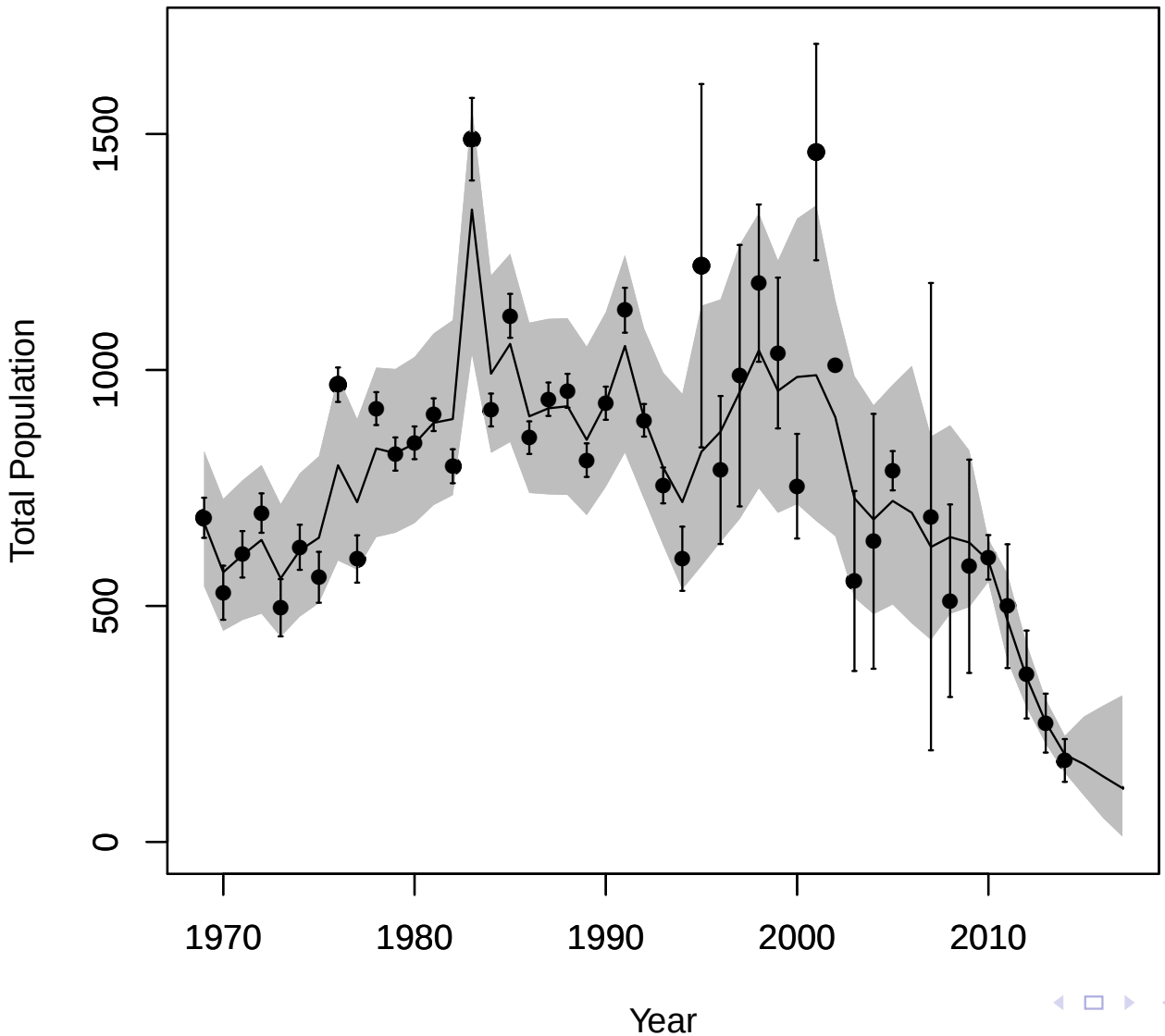
2000 - Present

- Research and modeling to determine "ecosystem carrying capacity"
- Findings released to public
- Alternatives for management presented
- Preferred alternative chosen
  - fencing
  - culling to maintain population at 600 - 800 animals



Population size over time



Why decline?

- Changes in migration patterns
- Harvest outside of park
- Culling within park
- Chronic wasting disease
- Serial drought

Aspen 2010

Aspen 2015


PhotoPoint: 2015-MP30-2
Location: 40° 21' 31.3" N 105° 35' 10.6" W
Bearing: 232.0
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Willow 2012

Willow communities

Going forward